

UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 2009/2010

April/May 2010

IBG 204 – BIOANALYSIS II
[BIOANALYSIS II]

Duration: 3 hours
[Masa: 3 jam]

Please check that this examination paper consists of SEVEN pages of printed material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi TUJUH muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instructions: Answer any **FIVE (5)** questions. You may answer the questions either in Bahasa Malaysia or in English.

Arahan: Jawab mana-mana **LIMA (5)** soalan. Anda dibenarkan menjawab soalan sama ada [untuk KBI] dalam Bahasa Malaysia atau Bahasa Inggeris.]

In the event of any discrepancies, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai].

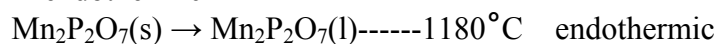
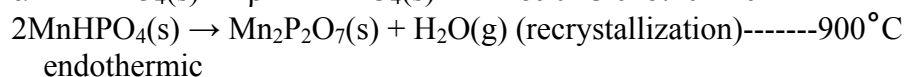
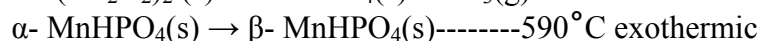
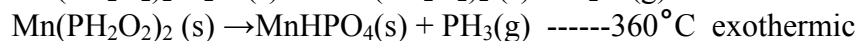
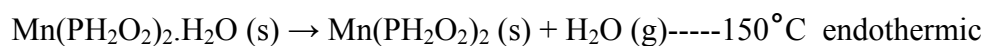
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1. Answer all parts of this question.
 - (a) Classify separation techniques on the basis of physical properties and molecular characteristic of substances.
(4 marks)
 - (b) Briefly describe all of the following:
 - (i) Normal and reversed phase chromatography.
 - (ii) Height equivalent to theoretical plates.
 - (iii) Capacity factor.
(6 marks)
 - (c) Describe the steps of affinity chromatographic method, and state how pH and dielectric constant regulate complementary molecules removal.
(10 marks)
2. Answer all parts of this question.
 - (a) With the help of a schematic diagram, describe the principles and instrumentation of high performance liquid chromatography.
(10 marks)
 - (b) Explain how iso-electric focusing separates different molecules according to their different pI values. State the significance of polyamino-polycarboxylic acids in iso-electric focusing technique.
(10 marks)
3. Answer all parts of this question.
 - (a) Draw energy level diagram illustrating energy changes associated with absorption of electromagnetic radiation, from ground state to first level of excitation.
(5 marks)
 - (b) Deduce the expression $A = \epsilon bc$.
(5 marks)

- (c) How does weak acid cause chemical deviation from Beer's law? (5 marks)
- (d) A 25 ppm solution of a metabolite isolated from *Trichoderma* spp. was found to give an absorbance of 0.75 in a 2 cm cell. Calculate the absorptivity. (5 marks)

4. Answer all parts of this question.

- (a) With the help of schematic diagrams describe the principle of DTA and DSC. (5 marks)
- (b) The following information illustrates the thermal decomposition reactions and phase changes with temperature of manganese phosphinate monohydrate.

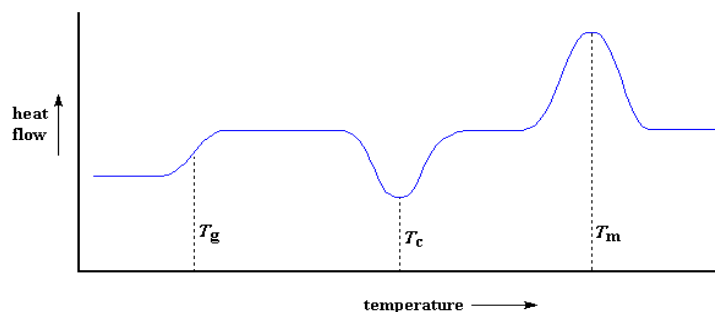


Draw TGA and DTA curves.

(5 marks)

- (c) Discuss the following figure and define the terms T_g , T_m and T_c .

(5 marks)



- (d) Briefly explain the suitability of DSC for biomolecules.

(5 marks)

5. Answer all parts of this question.
- (a) Depict x-ray diffraction spectroscope in a schematic diagram and briefly discuss its components.
(5 marks)
 - (b) Describe the powder diffraction method.
(6 marks)
 - (c) Briefly explain the differences between elastic and inelastic x-ray scattering techniques.
(5 marks)
 - (d) Discuss the limitations of x-ray crystallography.
(4 marks)
6. Answer all parts of this question.
- (a) What are electrochemical biosensors? Describe amperometric or potentiometric biosensors.
(10 marks)
 - (b) Describe immunological methods of analysis. Explain the role of antibodies and antigens in this method.
(10 marks)

1. Jawab semua bahagian dalam soalan ini.

(a) Klasifikasikan teknik pemisahan berdasarkan sifat fizikal dan ciri molekul bahan.

(4 markah)

(b) Jelaskan secara ringkas semua yang berikut:

(i) Kromatografi normal dan fasa berbalik.

(ii) Ketinggian setara dengan plat teoritis.

(iii) Faktor kapasiti.

(6 markah)

(c) Huraikan langkah-langkah kaedah kromatografi afiniti, dan nyatakan bagaimana pH dan pemalar dielektrik mengawal penyingkiran molekul pelengkap.

(10 markah)

2. Jawab semua bahagian dalam soalan ini.

(a) Dengan bantuan rajah berskema, jelaskan prinsip-prinsip dan peralatan kromatografi cecair berprestasi tinggi.

(10 markah)

(b) Terangkan bagaimana penumpuan iso-elektrik memisahkan molekul yang berbeza menurut nilai pI. Nyatakan kepentingan asid poliamino-polikarboksilik di dalam teknik penumpuan iso-elektrik.

(10 markah)

3. Jawab semua bahagian dalam soalan ini.

(a) Lakarkan satu rajah aras tenaga yang menggambarkan perubahan tenaga yang berkaitan dengan penyerapan sinaran elektromagnet, aras asas hingga aras pertama pengujaaan.

(5 markah)

(b) Deduksikan ekspresi $A = \epsilon bc$.

(5 markah)

(c) Bagaimanakah asid lemah menyebabkan penyimpangan kimia daripada hukum Beer?

(5 markah)

(d) Suatu larutan metabolit 25 ppm yang dipencilkan daripada *Trichoderma* spp. memberikan penyerapan 0.75 dalam sel 2 cm. Hitung kedayaserapan.

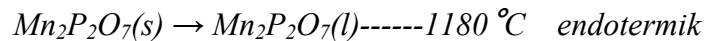
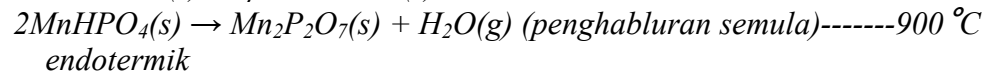
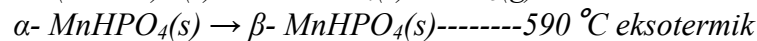
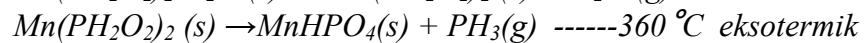
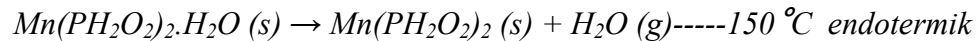
(5 markah)

4. Jawab semua bahagian dalam soalan ini.

(a) Dengan bantuan rajah berskema, huraikan prinsip-prinsip DTA dan DSC.

(5 markah)

(b) Maklumat berikut menggambarkan tindakbalas dekomposisi terma dan perubahan fasa dengan suhu untuk mangan fosfinat monohidrat.

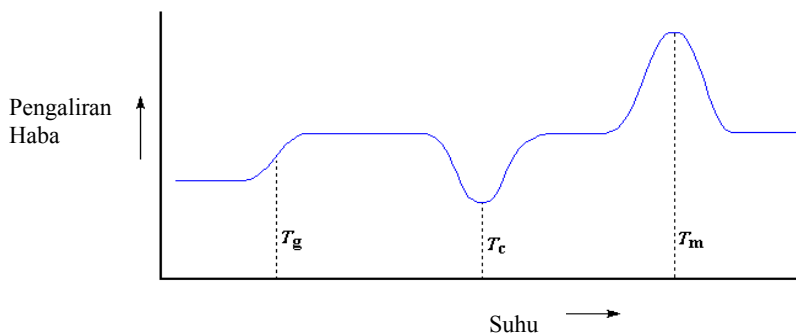


Lukiskan keluk TGA dan DTA.

(5 markah)

(c) Bincangkan rajah berikut dan definisikan istilah-istilah T_g , T_m dan T_c .

(5 markah)



(d) Jelaskan secara ringkas kesesuaian DSC untuk biomolekul.

(5 markah)

5. *Jawab semua bahagian dalam soalan ini.*

(a) *Lakarkan spektroskop pembelauan sinar-x dalam satu rajah berskema dan bincangkan secara ringkas komponen-komponennya.*

(5 markah)

(b) *Huraikan kaedah pembelauan serbuk.*

(6 markah)

(c) *Jelaskan secara ringkas perbezaan antara teknik penyerakan sinar-x elastik dan takelastik.*

(5 markah)

(d) *Bincangkan batasan-batasan kristalografi sinar-x.*

(4 markah)

6. *Jawab semua bahagian dalam soalan ini.*

(a) *Apakah biosensors elektrokimia? Huraikan biosensor amperometrik atau potentiometrik*

(10 markah)

(b) *Huraikan kaedah analisis imunologi. Jelaskan peranan antibodi dan antigen dalam kaedah ini.*

(10 markah)

